RESEARCH DEPARTMENT

Visit to Holland—1st–5th November, 1954

Report No. C.086

Serial No. 1954/42

THE BRITISH BROADCASTING CORPORATION
ENGINEERING DIVISION

RESEARCH DEPARTMENT

VISIT TO HOLLAND——1st-5th NOVEMBER, 1954

Report No. C.086

Serial No. 1954/42

P.E. Axon, O.B.E., Ph.D., M.Sc., A.M.I.E.E.

P.E. Axon

(P.E. Axon)

This Report is the property of the British Broadcasting Corporation and may not be reproduced or disclosed to a third party in any form without the written permission of the Corporation.

Report No. C.086

VISIT TO HOLLAND—1st-5th NOVEMBER, 1954

Summary Title Page

1 VISIT TO PHILIPS' LABORATORIES—EINDHOVEN 1

1.1. Demonstration of Stereophony and "Artificial" Diffusion 1

1.2. Television Magnetic Recording 2

1.3. Recording Machine Development 3

1.4. Colour Television 3

2 VISIT TO RADIO-UNIE—HILVERSUM 4

CONFIDENTIAL

Report No. C.086

December 1954 Serial No. 1954/42

VISIT TO HOLLAND——1st-5th NOVEMBER, 1954

1. VISIT TO PHILIPS' LABORATORIES——EINDHOVEN

1.1. Demonstration of Stereophony and "Artificial" Diffusion

During the first part of my visit to these laboratories, I was given various demonstrations of stereophony and "artificial" diffusion, the latter involving the use of a magnetic recording delay-system.

Trick effects of stereophony were first demonstrated with various recorded street noises. The demonstration was arranged with a battery of eight loudspeakers distributed across the front of a large baffle at one end of a studio. Quite realistic effects were obtained, the source of sound such as motorcycles and horses hoofs appearing to move from right to left across the baffle. The effects were obtained by increasing the level in the end loudspeaker then gradually decreasing it as the level in the adjacent speaker was increased and so on across the baffle. Although an interesting demonstration it is difficult to imagine any conditions in which this complicated set-up could be used, apart from the "Cinerama" at present being staged in London. The demonstration of stereophonic reproduction of orchestral music which followed was less impressive. This was done with a twin-track recording system replayed through two loudspeakers, one at either end of the large baffle. I must confess that the only impression I got from this was that the sound was coming from two loudspeakers which gave me no increased impression of reality.

In demonstrating the effects of "artificial" diffusion, a magnetic recording delay system was employed similar to that in use in our artificial reverberation machine. An essential difference, however, was that the output from each reproducing head around the magnetic disk was fed to a separate loudspeaker chain. The various loudspeakers were then placed around the room (near the ceiling) in a pattern which depended on the particular delay time with which they were associated. Thus, when an orchestral, or other source of programme, was reproduced the initial sound was directed at the listener from the front loudspeakers and subsequent "echoes" (at lower level) came from the loudspeakers spaced along the side and rear walls. This gave a marked impression of spaciousness in comparison with the original somewhat "dry" sound although it must be remembered that the effect would be obtained also, possibly to a lesser extent, if the original and delayed sounds were fed through the same loudspeaker, as in an artificial reverberation machine working without feedback. The delay system, as employed by Philips, involves no feed-back and since each successive reproducing head feeds a different loudspeaker, no effects of colouration or resonance are experienced, whatever the reproducing head spacings. Here again, however, it is difficult to imagine what this sound reproducing system, which involves a tremendous amount of technical equipment, could achieve in a normal field other than public address systems. It is worth noting, however, that such a system is usually installed to increase intelligibility in buildings (such as St.Paul's Cathedral) which have already too much internal reflection. A more modest variation of the system, however, which has a possible application in the broadcasting field was demonstrated to me at Radio-Unie Headquarters in Hilversum and this will be discussed in more detail in Section 2.

The delay-system demonstrated at Philips' laboratories suffered from very obvious modulation noise effects due, as far as I could diagnose, to imperfections of the magnetic delay-system.

1.2. Television Magnetic Recording.

I had some discussion with Recording and Television Sections of the laboratories on the problems of television magnetic recording. Although willing to discuss the subject in general terms, the engineers at Philips were obviously not prepared, at first, to discuss certain particular difficulties very specifically. I did, however, gain rather more useful information than I expected after the discussion "warmed up" and we were able to detect (mutually) common problems. Philips are working on television magnetic recording and so far they have obtained results on similar lines to ours with a rotating disk experiment. The system they have adopted is as follows. Resting on the face of the non-magnetic disk, which I presume is rotating horizontally, is a sheet of magnetically coated film, cut in the form of a disk and similar, no doubt, to those which E.M.I. issue for use on their office recording equipment. The magnetic heads are pressed down upon this disk of magnetic material at points between two embossed circular ridges so that there is some contact between the head and magnetic material. It is obvious, however, that the magnetic medium must bend away, to some extent, from the edges of the head towards the centre, reducing the effective contact and lowering the reproduced level of high frequencies. I was told that with this system they had recorded 1½ Mc/s at a recording speed of 15 m/s which corresponds, roughly, to the recording of 250 kc/s at 100 in./sec. This is more like the figure we should expect to obtain in contact recording and it is well below the figures reputed to have been obtained by R.C.A. It is, in fact, a reasonable figure, on the basis of our experience, which the R.C.A. figures are not. Philips admitted they were in great fundamental difficulty with recording of low frequencies and this, too, we would expect in a wide-band system using conventional reproducing heads and high recording speeds. Philips are using Ferroxcube heads and they claim to employ an effective reproducing gap of three microns. To obtain a gap of this order requires, they state, great precision of working and very careful selection of the Ferroxcube cores. They report that Ferroxcube is very difficult to machine for this purpose and that even nominally identical specimens of core from the same mix do not seem to produce the same results when machined. They could not feel confident of obtaining such results if they had not, behind them, the factory which manufactures Ferroxcube and from which they are able to obtain a large range of Ferroxcube core material specially prepared for the purpose. This confirms experience in Research Department in finding Ferroxcube extremely difficult to polish. It will obviously take us much longer to obtain a number of satisfactory specimens if we can only draw from the stock of cores and materials held by Mullards in this country. In this connection the Philips' engineers undertook to consider, in consultation with their management, whether they could supply Research Department with selected cores and I hope to hear more of this in the future.

In obtaining the results quoted above h.f. bias was not employed in the recording head and Philips consider that in this application there is little advantage to be gained in using it providing a certain measure of distortion can be tolerated. In dealing with the problem it is our experience, also, that bias does little to promote the recording of high frequencies. In fact, however excellent the reproducing gap obtainable an equally important problem is that of recording the high frequencies at all. If a very short-gap recording head, with a very sharp cut-off of field at the edges of the gap, could be obtained, then undoubtedly good high frequency recording could be achieved, providing core losses are small. A fundamental difficulty arises in this connection, however, for if the gap of the recording head is made very short then the reluctance across it decreases and hence the leakage field outside, on which recording depends, becomes very small. Increasing the recording gaplength, in order to increase the leakage field, results also in making the cut-off of field more gradual at the edges so that the recording of high frequencies becomes inefficient. Obviously the gapwidth of both recording and reproducing heads must be a compromise and Philips state that they have had to introduce a spacer to make the gapwidth up to three microns otherwise the heads are quite inefficient. This makes the R.C.A. results even more remarkable.

Philips indicated that they were not considering a multi-track system at the moment. If they have rejected the multi-track system (on paper), however, and have only, so far, obtained the results quoted to me, they are a long way from a quick, reasonable answer.

1.3. Recording Machine Development.

I also visited the Development Section of the Philips organisation which is concerned with magnetic recording machines. They demonstrated the prototype of a transportable, or cabinet mounted, recording machine working at 15 in./sec tape speed with a frequency response up to 15 kc/s. No critical listening conditions were available, but the machine seemed a high-quality product with all the usual facilities and a well-designed tape transport system. Another machine demonstrated to me was a 24-hour recorder with six channels, the recording and reproducing heads being arranged in an echelon formation across ½-inch tape. These machines are designed to work in pairs and various safety factors are incorporated, such as a failure in one machine causing the adjacent one to start up. This has, I gather, been developed especially for airport use in the recording of R.T. conversations between Traffic Control and aircraft.

1.4. Colour Television.

I was given a brief demonstration of some colour television work on which Philips were engaged. A copy of the N.T.S.C. system, modified to the European standards, was demonstrated on a three-colour tube. The picture obtained was satisfying enough but the tube itself did not seem to be so good as the two available in Research Department, which themselves show a variation one to the other. Another variation demonstrated was a two sub-carrier system occupying a bandwidth of 6 Mc/s with the sub-carriers 1 Mc/s on either side of the luminance signal. A mesh interference pattern, corresponding to the dot-pattern interference in the single sub-carrier system, was quite noticeable. The receiver employed in this case was a three-tube and filter projection system using projection tubes manufactured by Philips themselves. These tubes were said to cost in the region of £7 each and the picture obtained was very satisfactory although there were some errors in registration, especially at the edges of the picture. It seemed to me that they would sell this projection system easily, on the basis of cost, if they did not attempt to enlarge it so much, when all the faults of registration became much more noticeable. The picture area was at least twice as great as that of the three-colour tube with which it was to be compared. Another demonstration in which the three-colour signals were taken through three separate channels and fed into the projection receiver without any encoding was of no particular development interest. The red channel was very noisy compared to the other two and this they put down to a poor photo-multiplier in the red channel. If this was so it is interesting to realise how much on the "top-line" the performance of the photo-multipliers will have to be.

2. VISIT TO RADIO-UNIE---HILVERSUM

On my visit to Radio-Unie I saw both Mr. Huydts, Technical Director, and Dr. Geluk his deputy who is also directly responsible for the research and development activities. Radio-Unie is responsible for the technical facilities of the four sound broadcasting organisations which exist in Holland and it has no responsibilities for television. Most of the studio equipment, with the exception of recording machines, is developed in the Radio-Unie Technical Centre and is standard in all four studio premises. Standardisation is carried further in that the same size of cabinet and unit chassis is used for all purposes. The chassis standardisation also extends to the outside broadcast equipment, both transportable and as carried in the O.B. vans. A considerable amount of O.B. equipment was under development, including a new O.B. amplifier system and R.T. equipment to work in conjunction with it. In their O.B. system they propose to make much use of R.T., as opposed to land-line, communication and they have under development low-power F.M. "walkie-talkie" sets working at 6 Mc/s. This equipment will be used by interviewers or commentators, up to six in number, for feeding into the O.B. van. Talk-back from the van to the interviewers will be A.M. on 2 Mc/s using rather more power.

In the field of magnetic recording they are doing no development, but they are proceeding with general matters of standardisation and tape testing. They reported good agreement with the test tapes recently circulated by Designs Department. New recording machines which they are bringing into use are transportable, professional type models manufactured by an Austrian licensee of Philips. Philips have now ceased to manufacture this particular equipment and I was informed that the product of the Austrian licensee was superior to the equivalent formerly made by Philips, Eindhoven.

As mentioned in Section 1, a demonstration was also given to me here of the effect of "artificial" diffusion on a recorded or broadcast programme. The "artificial" diffusion was obtained in this case by a simple magnetic delay-system consisting of an endless loop running at slow speed over an erase head, a recording head and a single reproducing head. Feed-back was employed in the system so that some measure of artificial reverberation was obtained as well as the so-called "diffusion". The distinction between these two things is, of course, rather academic in relation to the delay system. In the arrangement demonstrated, the direct sound of the broadcast or recording was directed at the listener from loudspeakers in front of him and the output of the magnetic delay-system from two loudspeakers at the back of the room, behind and above him. On suitable recorded music this gave a satisfying improvement but, of course, the device has to be used with discretion otherwise amplitude flutter effects, arising in the feed-back system, became noticeable on sharp transients. Thus, if the disk is damaged, or has sharp surface noises, such as would arise from a scratch or dirt on the surface, then each "tick" or "pop" generates a regular series of decreasing amplitude.

Dr. Geluk points out that this system may be applicable to a high-quality broadcasting system in two alternative ways. Firstly the original sound could be fed along one channel and the delayed sound along a second, the two channels being fed to front and back loudspeakers in the listeners home. He maintains, with some reason, I think, that this will provide more satisfying results than could be obtained by occupying the two channels with a stereophonic system. I gathered that the relative advantages of the "diffusion" system, and of stereophony, were at least being discussed in Holland in connection with wire broadcasting where either is said to be feasible if there were sufficient demand for it. Alternatively if only one channel is available, the comparatively simple system described could form part of the listener's home installation. The incoming direct sound would then be delayed by his own delay device and fed to the loudspeakers placed at the back of the room. This struck me as quite an interesting idea which would not affect the fundamental broadcasting system in any way and could be installed at the will of the listener.